REMARKS

This is a full and timely response to the outstanding Office Action mailed December 4, 2008. Upon entry of the amendments in this Request for Continued Examination, claims 1, 3-12, 14-15 and 25-26 remain pending, with claims 5 and 6 being withdrawn. In particular, Applicant has amended claims 1, 3, 11, and 12, and has added claims 25 and 26. Support for these amendments can be found at various portions of the application. No new mater has been added. Reconsideration and allowance of the application and presently pending claims are respectfully requested

Rejections under 35 U.S.C. 112

The Office Action indicates that claims 1, 7-10, 11, 14, and 15 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. As set forth above, Applicant has amended claims 1 and 11, and respectfully asserts that the rejections as to these claims have been accommodated.

Rejections under 35 U.S.C. 103

The Office Action indicates that claims 1, 3, 7, 8, 9, 11, and 14 are rejected under 35 U.S.C. 103 (a) as being unpatentable over *MacNeil* (U.S. Pub No. 2001/0030369) in view of Zhang (U.S. Pat No. 6,468,927); that claims 4 and 12 are rejected under 35 U.S.C. 103 (a) as being unpatentable over *MacNeil* in view of *Zhang* (U.S. Pat No. 6,468,927) and further in view of the ASA (The admitted state of the art as disclosed by the applicant); and that claims 9, 10, 14 and 15 are rejected under 35 U.S.C. 103 (a) as being unpatentable over *MacNeil* in view of *Zhang* and further in view of the *O'Neill* (U.S. Pat No. 6,716,770). Applicant respectfully traverses the rejections.

In this regard, it is noted that the prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Evidence showing there was no reasonable expectation of success may support a conclusion of nonobviousness. *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976)

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).* Additionally, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

Turning now to the claims, claim 1 (as amended) recites:

> Claim 1: A method of forming an inter-metal dielectric layer structure over a substrate, said method comprising:
> introducing a process gas to form a low-k dielectric layer over said substrate; and
> ***in situ introducing a reactant gas including nitrogen fluoride (NF_3) to etch back said low-k dielectric layer and to react with said process gas to form a dielectric layer containing an extra element on said low-k dielectric layer; wherein said extra element is provided by said reactant gas.***

(Emphasis Added).

Applicant respectfully asserts that amended claim 1 is patentable for at least the reasons that *MacNeil* fails to teach or disclose the features emphasized above in claim 1 and there is no motivation to combine the teachings of *Zhang* with the method of *MacNeil.* Notably, the Office Action admits that *MacNeil* fails to disclose NF_3. In this regard, the Office Action further asserts that *Zhang* discloses N_2 and NF_3 are known equivalents for providing nitrogen into the layer and, therefore, claim 1 would have been obvious because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Applicant respectfully disagrees.

With respect to *MacNeil*, *MacNeil* discloses:

> ". . . depending on the flow rate of the nitrogen, anything from a pure silicon carbide layer (with virtually no nitrogen present) to a carbon doped silicon nitride layer (with a high nitrogen flow) can be formed" and "by suitable adjustment of the nitrogen flow rate, nitrogen-doped silicon carbide films can be formed which have a k value similar to or equal to the carbon-doped silicon dioxide layer mentioned above. It is thus possible in a single chamber to form a dielectric stack consisting of carbon doped silicon dioxide layer, a nitrogen doped silicon carbide layer and a carbon doped silicon dioxide layer."

(See *MacNeil* at paragraphs [0026], for example).

Applicant notes that the dielectric stack of *MacNeil* is formed by introducing the **nitrogen gas** and adjusting the **nitrogen flow rate, rather than** introducing the **NF_3 gas** and adjusting the **NF_3 flow rate** (See the table shown in *MacNeil* at paragraph [0028]). Applicant respectfully submits that there is no evidence to show the dielectric stack of *MacNeil* can also be formed by adjusting the NF_3 flow rate instead of the nitrogen gas. There is also no evidence to show depending on the flow rate of NF_3, anything from a pure silicon carbide layer (with virtually no nitrogen present) to a carbon doped silicon nitride layer (with a high NF_3 flow) can be formed. Namely, no evidence showing there was reasonable expectation of success supports the proposed modification by the Office Action.

Applicant respectfully asserts that although N_2 and NF_3 are known equivalents for providing nitrogen into a dielectric layer, this merely implies the nitrogen-containing layer can be formed using N_2 and NF_3; however, this does not imply that the N_2 gas used in the method of *MacNeil* can be instead of NF_3 gas. In fact, the proposed modification by the Office Action would change the principle of operation of *MacNeil* and/or render *MacNeil* unsatisfactory for its intended purpose. This is because fluorine from NF_3 gas may affect the dielectric layer during deposition of the dielectric layer by the method of *MacNeil*. As such, the teachings of *Zhang* are not sufficient to render the limitations of claim 1 obvious and there is no suggestion or motivation to make the proposed modification. Since *MacNeil* **does teach** adjustment of **nitrogen rather than NF$_3$** flow rate, Applicant respectfully asserts that the proposed modification by the Office Action is unsupported by any factual evidence.

As set forth above, Applicant respectfully asserts that *MacNeil* does not teach or reasonably suggest at least the features/limitations that have been emphasized above in independent claim 1. Moreover, there is no motivation to combine the teaching of *Zhang* with that of *MacNeil.* Additionally, with respect to the Office Action's reliance on ASA and *O'Neill*, these tertiary references are merely relied on for teachings related to various dependent claims. Notably, these references do not remedy the deficiencies noted above with respect to the rejection of claim 1 under *MacNeil and Zhang*. Accordingly, Applicant respectfully asserts that the rejection of claim 1 is deficient and this claim is in condition for allowance. Further, claims 3, 4, 7, 8, and 9 are believed to be allowable for at least the reason that these claims depend from allowable independent claim 1. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

With respect to claim 11, that claims is amended to recite:

> Claim 11: A method of forming an inter-metal dielectric layer structure over a substrate, said method comprising:
> introducing a process gas to form a low-k dielectric layer over said substrate; and
> ***in situ introducing a reactant gas including nitrogen fluoride (NF$_3$) to etch back said low-k dielectric layer and to react with said process gas to form a dielectric layer containing an extra element on said low-k dielectric layer***;
> wherein said extra element is provided by said reactant gas, a volume ratio of said reactant gas to said process gas is larger than about 2.

(Emphasis Added).

Applicant respectfully asserts that amended claim 11 is patentable for at least the reasons that *MacNeil* fails to teach or disclose the features emphasized above in claim 11 and there is no motivation to combine the teachings of *Zhang* with the method of *MacNeil.* Notably, the Office Action admits that *MacNeil* fails to disclose NF$_3$. In this regard, the Office Action further asserts that *Zhang* discloses N_2 and NF_3 are known equivalents for providing nitrogen into the layer and, therefore, claim 11 would have been obvious because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Applicant respectfully disagrees.

With respect to *MacNeil*, *MacNeil* discloses:

> ". . . depending on the flow rate of the nitrogen, anything from a pure silicon carbide layer (with virtually no nitrogen present) to a carbon doped silicon nitride layer (with a high nitrogen flow) can be formed" and "by suitable adjustment of the nitrogen flow rate, nitrogen-doped silicon carbide films can be formed which have a k value similar to or equal to the carbon-doped silicon dioxide layer mentioned above. It is thus possible in a single chamber to form a dielectric stack consisting of carbon doped silicon dioxide layer, a nitrogen doped silicon carbide layer and a carbon doped silicon dioxide layer."

(See *MacNeil* at paragraphs [0026], for example).

Applicant notes that the dielectric stack of *MacNeil* is formed by introducing the **nitrogen gas** and adjusting the **nitrogen flow rate, rather than** introducing the **NF$_3$ gas** and adjusting the **NF$_3$ flow rate** (See the table shown in *MacNeil* at paragraph [0028]). Applicant respectfully submits that there is no evidence to show the dielectric stack of *MacNeil* can also be formed by adjusting the NF_3 flow rate instead of the nitrogen gas. There is also no evidence to show depending on the flow rate of NF_3, anything from a pure silicon carbide layer (with virtually no nitrogen present) to a carbon doped silicon nitride layer (with a high NF_3 flow) can be formed. Namely, no evidence showing there was reasonable expectation of success supports the proposed modification by the Office Action.

Applicant respectfully asserts that although N_2 and NF_3 are known equivalents for providing nitrogen into a dielectric layer, this merely implies the nitrogen-containing layer can be formed using N_2 and NF_3; however, this does not imply that the N_2 gas used in the method of *MacNeil* can be instead of NF_3 gas. In fact, the proposed modification by the Office Action would change the principle of operation of *MacNeil* and/or render *MacNeil* unsatisfactory for its intended purpose. This is because fluorine from NF_3 gas may affect the dielectric layer during deposition of the dielectric layer by the method of *MacNeil*. As such, the teachings of *Zhang* are not sufficient to render the limitations of claim 11 obvious and there is no suggestion or motivation to make the proposed modification. Since *MacNeil* **does teach** adjustment of **nitrogen rather than NF_3** flow rate, Applicant respectfully asserts that the proposed modification by the Office Action is unsupported by any factual evidence.

As set forth above, Applicant respectfully asserts that *MacNeil* does not teach or reasonably suggest at least the features/limitations that have been emphasized above in independent claim 11. Moreover, there is no motivation to combine the teaching of *Zhang* with that of *MacNeil*. Additionally, with respect to the Office Action's reliance on ASA and *O'Neill*, these tertiary references are merely relied on for teachings related to various dependent claims. Notably, these references do not remedy the deficiencies noted above with respect to the rejection of claim 11 under *MacNeil and Zhang*. Accordingly, Applicant respectfully asserts that the rejection of claim 11 is deficient and this claim is in condition for allowance. Further, claims 12, 14, and 15 are believed to be allowable for at least the reason that these claims depend from allowable independent claim 11. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Newly Added Claims

Applicant respectfully submits that claims 25 and 26 are allowable due to their respective dependence on independent 1. Additionally or alternatively, these claims are believed to be allowable for the additional recitations included in these claims. Favorable consideration and allowance of newly added claims 25 and 26 are respectfully requested.

CONCLUSION

In light of the foregoing amendments and for at least the reasons set forth above, Applicants respectfully submit that all objections and/or rejections have been traversed, rendered moot, and/or accommodated, and that the now pending claims are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested.

Any other statements in the Office Action that are not explicitly addressed herein are not intended to be admitted. In addition, any and all findings of inherency are traversed as not having been shown to be necessarily present. Furthermore, any and all findings of well-known art and Official Notice, or statements interpreted similarly, should not be considered well-known for the particular and specific reasons that the claimed combinations are too complex to support such conclusions and because the Office Action does not include specific findings predicated on sound technical and scientific reasoning to support such conclusions.

If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

Respectfully submitted,

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